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Geology, Energy, and Mineral (GEM) Resource Evaluation of Box Creek GRA, Idaho, including the Box Creek (110-91a) Wilderness Study Area

Bureau of Land Management
Contract No. YA-553-CT2-1039

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By:

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ANCHORAGE, ALASKA
JULY 1983

WGM INC.
MINING AND GEOLOGICAL CONSULTANTS

CLASSIFICATION OF GEM RESOURCE POTENTIAL OF THE BOX CREEK WSA (191-19a), IDAHO

	Classification
1. Locatable Resources	
a. Metallic Minerals	2A
b. Uranium and Thorium	2C
c. Non-Metallic Minerals	2B
2. Leasable Resources	
a. Oil and Gas	1D
b. Low Temperature Geothermal	1B
High Temperature Geothermal	1B
c. Sodium and Potassium	1D
d. Other	1D
3. Saleable Resources	2D

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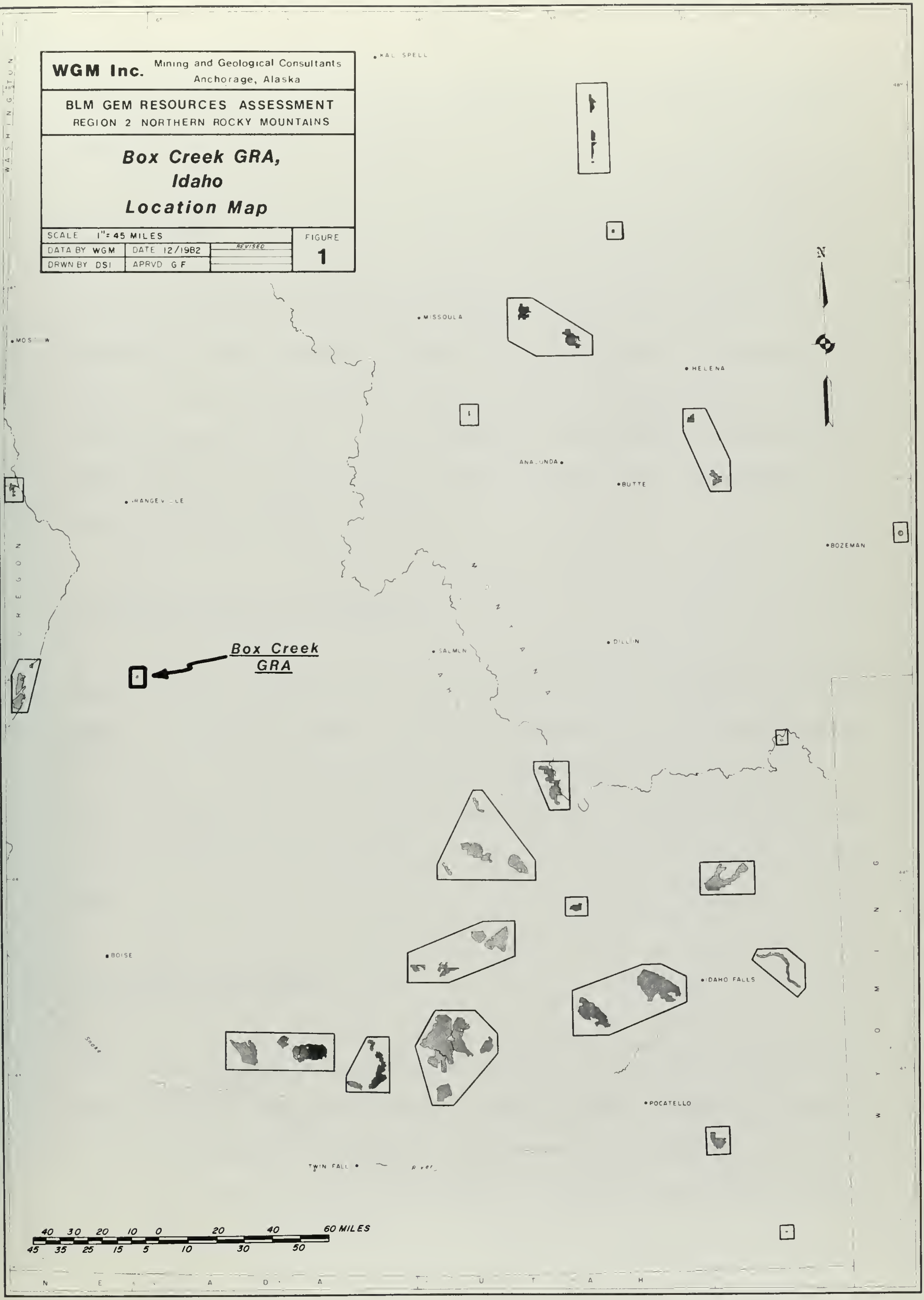
BOX CREEK GRA, IDAHO

1.0 INTRODUCTION

The Bureau of Land Management has adopted a two-phase procedure for the integration of geological, energy and minerals (GEM) resources data into the suitable/non-suitable decision-making process for Wilderness Study Area (WSAs). The objective of Phase I is the evaluation of existing data, both published and available unpublished data, and evaluation of the data for interpretation of the GEM resources potential of the WSAs. Wilderness Study Areas are grouped into areas based on geologic environment and mineral resources for initial evaluation. These areas are referred to as Geology, Energy, Mineral Resource Areas (GRAs).

The delineation of the GRAs is based on three criteria: (1) a 1:250,000 scale map of each GRA shall be no greater than 8½ x 11 inches; (2) a GRA boundary will not cut across a Wilderness Study Area; and (3) the geologic environment and mineral occurrences. The data for each GRA is collected, compiled, and evaluated and a report prepared for each GRA. Each WSA in the GRA is then classified according to GEM resources favorability. The classification system and report format are specified by the BLM to maintain continuity between regions.

This report is prepared for the Bureau of Land Management under contract number YA-553-CT2-1039. The contract covers GEM Region 2; Northern Rocky Mountains (Fig. 1). The Region includes 50 BLM Wilderness Study Areas



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Anchorage, Alaska

BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho Location Map

SCALE 1" = 45 MILES		REVISED	FIGURE 1
DATA BY WGM	DATE 12/1982		
DRWN BY DSI	APRVD G F		

totalling 583,182 acres. The WSAs were grouped into 22 GRAs for purposes of the Phase I GEM resources evaluation.

1.1 Location

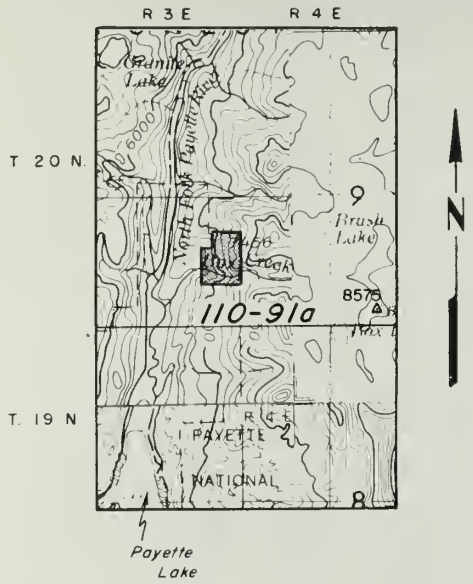
The Box Creek GRA is located in northwestern Valley County, Idaho and centered 8.5 miles northeast of McCall in Ts.19 and 20N., Rs.3 and 4E. (Fig. 2). Administratively the area is within the Cascade Resource Area in the Boise BLM district. The GRA encompasses approximately 60 square miles. The Box Creek Wilderness Study Area (WSA 119-91a), which encompass 428 acres, is the only WSA in the GRA.

1.2 Population and Infrastructure

McCall, population 2,200 and the largest community in the area, is 8.5 miles south of the Box Creek GRA. There are no settlements within the boundaries of the GRA. A light duty gravel road through the GRA, runs north-south along the valley of the North Fork of the Payette River passing within one mile of the Box Creek WSA (110-91a). U.S. 95 is about 12 miles west of the WSA.

1.3 Basis of the Report

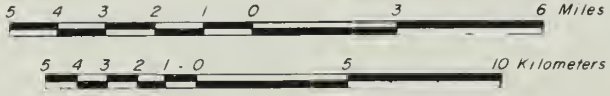
This report is based on a compilation, review, and analysis of available published and unpublished data on the geology, energy, and mineral resources of the Box Creek GRA. A portion of the area has been mapped by the USGS (Hamilton, 1969) at a scale of 1:125,000. A geologic map has been compiled



BLM Wilderness Study Areas Included in the Box Creek GRA.

WSA	NAME	ACREAGE
110-91a	Box Creek	428

▨ Approximote Boundary of Wilderness Study Area.



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BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho

Topographic Map

SCALE 1" = 4 MILES (1:250,000)		FIGURE
DATA BY WGM	DATE 9/1982	REVISED
DRWN BY DSI	APRVD G.F.	2

by Gaston and Bennett (1979), Mitchell and Bennett (1979), and Rember and Bennett (1979). WGM Inc. personnel visited the Box Creek WSA on October 15, 1982 and collected stream sediment samples as part of this study. The data was compiled and reviewed by WGM project personnel and the panel of experts to produce the resource evaluation contained in this report. Personnel consist of:

Greg Fernette, Senior geologist, WGM Inc.	Project Manager
C.G. Bigelow, President, WGM Inc.	Chairman, Panel of Experts
Joel Stratman, Geologist, WGM Inc.	Project Geologist
Jami Fernette, Land and Environmental Coordinator, WGM Inc.	Claims and Lease Compilation

Panel of Experts

C.G. Bigelow, President, WGM Inc.	Regional geology, metallic and non-metallic minerals, mineral economics.
R.S. Fredericksen, Senior Geologist, WGM Inc.	Regional geology, metallic minerals.
David Blackwell, Ph.D., Professor of Geophysics, Southern Methodist University	Geothermal.
Jason Bressler, Senior Geologist, WGM Inc.	Regional geology, metallic minerals.
Gary Webster, Ph.D., Chairman, Department of Geology, Washington State University	Oil and gas.
William Jones, Senior Geologist, WGM Inc.	Metallic minerals, coal, industrial minerals.
J.F. McOuat, President, Watts, Griffis & McOuat Ltd.	Mineral economics, and industrial minerals.
E.F. Evoy, Senior Geologist, Watts, Griffis & McOuat Ltd.	Uranium and thorium.

1.4 Acknowledgements

We would like to thank Fred Anderson, Boise district geologist, for assistance in the compilation phase of this study.

2.0 GEOLOGY

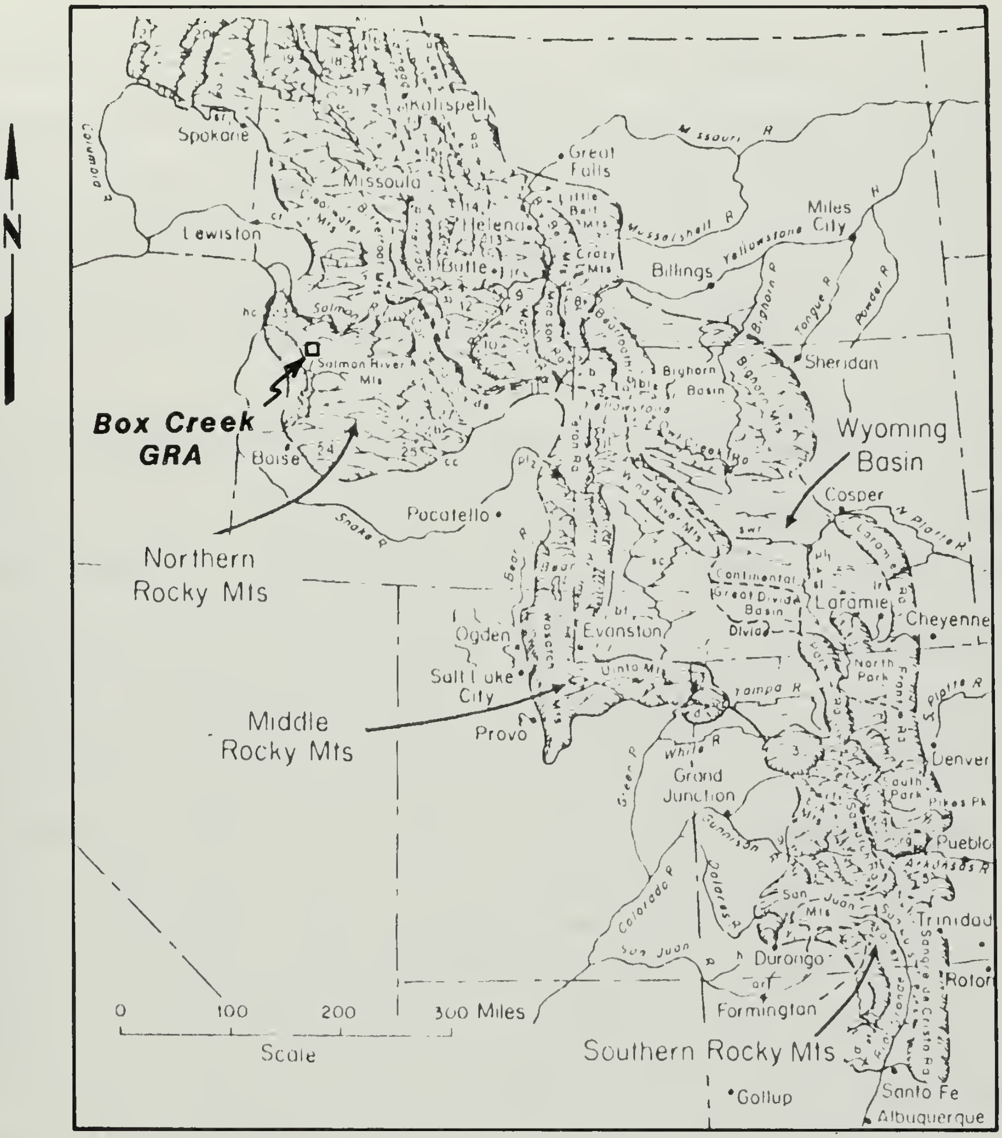
2.1 Introduction

Plutonic rocks from Jurassic (195-141 m.y.) to Cretaceous (141-65 m.y.) age underlie all of the Box Creek GRA. Regionally the GRA is on the western margin of the Idaho batholith, a large granitic body emplaced during Late Jurassic (158-141 m.y.) to Cretaceous time.

2.2 Physiography

The Box Creek GRA is in the Northern Rocky Mountains physiographic province (Fig. 3) (Hunt, 1974). The principal geomorphic features in the area are Payette Lake and the valley of the North Fork of the Payette River. Elevations within the GRA range from 4,990 feet at Payette Lake to 8,575 feet on the ridge near Box Lake. The local drainage system which is controlled by foliations of the Idaho batholith and its aureole, tends to have a trellis pattern with north-south trending trunks and east-west flowing branches.

The climate characteristically displays short, cool summers and fairly severe winters. Heaviest precipitation takes place in spring and fall. Snow, although occasionally present on higher slopes all year round, arrives in October and lingers until April. Total mean annual precipitation is 21.5 inches. Temperatures vary from a maximum of 96°F to -40°F (Savage, 1961).



Map from Hunt (1974).

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Anchorage, Alaska

BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho

Regional Physiographic Setting

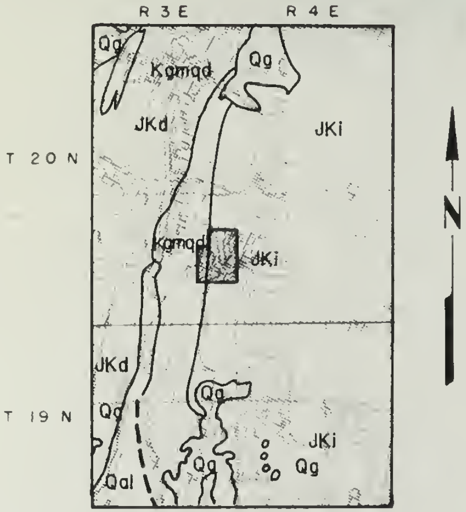
SCALE AS SHOWN
DATA BY
DATE 3/1983
REV SED
DRWN BY DSI
APRVD G F
FIGURE 3

2.3 Description of Rock Units

The Box Creek GRA is situated at the western margin of the Idaho batholith. The batholith is exposed from southern Elmore County, Idaho northward through the center of Idaho into Montana and is about 250 miles long and 90 miles in maximum width. The roof is relatively flat and its surface is inclined so that it is highest towards the south. The sides are fairly steep and flare outward (Ross and Forrester, 1958).

The main phase of the Idaho batholith ranges from muscovite-biotite-bearing granite (quartz monzonite) to granodiorite. Hornblende is generally absent. The mineralogy, the high $Al_2O_3/(Na_2O+K_2O+CaO)$ ratio and the compositional restriction to high SiO_2 rocks indicates that the biotite-muscovite granite is in an S-type granite -- that is derived by partial melting of sedimentary rocks (Hyndman, 1978). The main core of the batholith is surrounded by an incomplete, complex outer shell of metamorphic and igneous rocks, primarily gneiss and schist. This border zone is sometimes cut by rocks belonging to the main mass, but it also sometimes exhibits a broadly gradational relationship to the core (Ross and Forrester, 1958). Surrounding regional metamorphic rocks are broadly concentric with the batholith although locally, cross-cutting isograds are present (Hyndman, 1978). The Box Creek GRA straddles the boundary between the border zone and the main batholithic mass (Fig. 4).

The oldest rocks outcropping in the Box Creek GRA are gneissic biotite-quartz monzonite and diorite migmatite (Hamilton, 1969). The unit is comprised of quartz diorite gneiss which is highly injected, migmatized, and



EXPLANATION

	Sedimentary		Igneous			
CENOZOIC	Qal	Alluvium			Recent	Quaternary
	Qg	Glacial moraines			Pleis-tocene	
MESOZOIC			Ki	Idaho batholith	Cretaceous	
			Kqmqd	Quartz monzonite-quartz diorite migmatite		
			JKd	Late Jurassic and Cretaceous(?) intrusive rocks	Jurassic	

Data by: Gaston and Bennett. 1979
Mitchell and Bennett, 1979a,b
Rember and Bennett, 1979

▨ Approximate Boundary of Wilderness Study Area.

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Anchorage, Alaska

BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho

Geologic Map

SCALE 1"= 4 MILES			FIGURE
DATA BY	DATE 1/1983	REVISED	4
DRWN BY DSI	APRVD G.F		

metasomatized by gneissic quartz monzonite. The age of the rocks is considered to be Jurassic(?) and Cretaceous.

To the east and west of the migmatite are slightly younger units of gneissic biotite quartz monzonite and granodiorite. These rocks are mostly leucocratic with foliation and layering increasing westward. The unit includes small intercalations of gneissic quartz diorite and of quartz monzonite-quartz diorite migmatite (Hamilton, 1969). In the geologic map compilation by Gaston and Bennett (1979), Mitchell and Bennett (1979), and Rember and Bennett (1979) the eastern quartz monzonite and granodiorite unit of Hamilton (1969) is considered part of the Idaho batholith proper.

Potassium-argon fission-track dates from border zones of the batholith indicate emplacement occurred about 70-90 m.y. ago although most K-Ar dates have been reset to the 40-50 m.y. range by a later thermal event (Hyndman, 1978). Ross and Forrester (1958) quote an average age of 103 million years for the main mass of the batholith.

Quaternary (2 m.y. to present) glacial deposits of moraine and outwash are perched on the mountain slopes in several places and Quaternary alluvium underlies the valley of the North Fork of the Payette River between Box Creek and Payette Lake (Schmidt and Mackin, 1970).

2.4 Structural Geology and Tectonics

Much of the main mass exhibits weak foliation, but massive foliations within the gneissic and migmatitic terrane strike north to northeasterly and dip steeply to moderately southeast. About 25 miles south of the Box Creek GRA, the foliated zone is about 10 miles wide (Taubeneck, 1971). Only a few faults are present and these strike northerly.

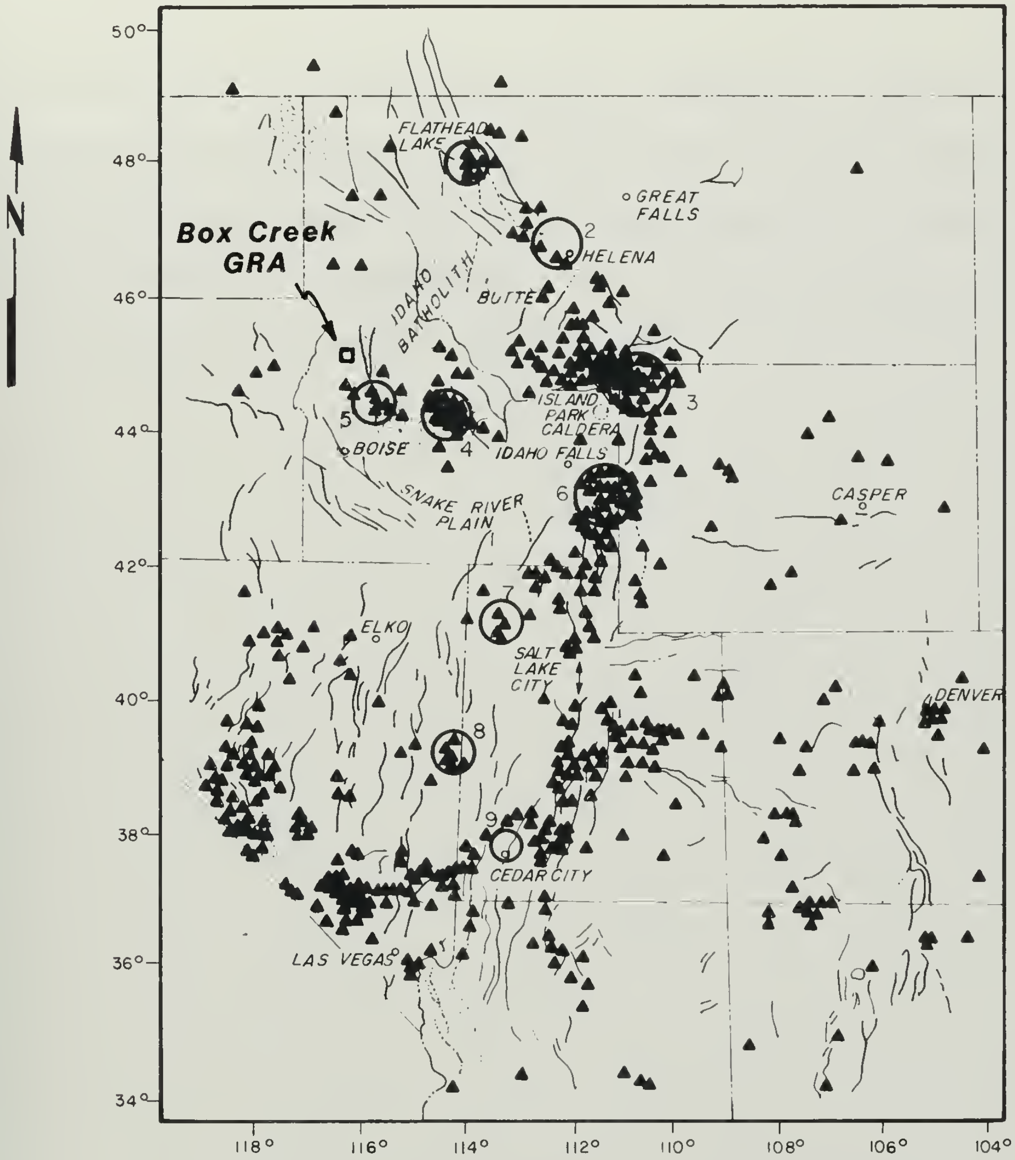
Any geologic hazards present are due strictly to the steep terrain and include hazards such as mud slides and flash floods. The area does not display high seismic activity (Fig. 5) but is near the Idaho batholith earthquake swarm (Smith and Sbar, 1974).

2.5 Paleontology

All bedrock in the area is plutonic or high grade metamorphic units; thus, no fossils are present.

2.6 Historical Geology

The Cordilleran Geosynclinal trough of the western United States received sediments and volcanic detritus from late Precambrian (more than 600 m.y. ago) through Jurassic time. Major orogenic activity was initiated in Late Jurassic through Cretaceous during which melting of deep portions of the sedimentary pile yielded the belt of granitic batholiths stretching from Baja, California north to the Yukon-Alaska border. Major batholithic



EPICENTERS FOR INTERMOUNTAIN SIESMIC BELT SHOWING ALL EARTHQUAKES REPORTED BY NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) OF ABOUT MAGNITUDE 3.0 OR GREATER FROM 1961 THROUGH 1970. DOUBLE ARROW SHOWS ZONE OF LOW SIESMICITY. CIRCLES MARK EARTHQUAKE SWARMS: 1, FLATHEAD LAKE, MONT.; 2, HELENA, MONT.; 3, YELLOWSTONE PARK; 4, SAWTOOTH RANGE, IDAHO; 5, IDAHO BATHOLITH; 6, CARIBOU RANGE, IDAHO; 7, GREAT SALT LAKE DESERT, UTAH; 8, LEHMAN CAVE MONUMENT, NEVADA; 9, CEDAR CITY, UTAH

DATA FROM SMITH AND SBAR (1974)

0 70 140 210 MILES

SCALE APPROXIMATE

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REGION 2 NORTHERN ROCKY MOUNTAINS

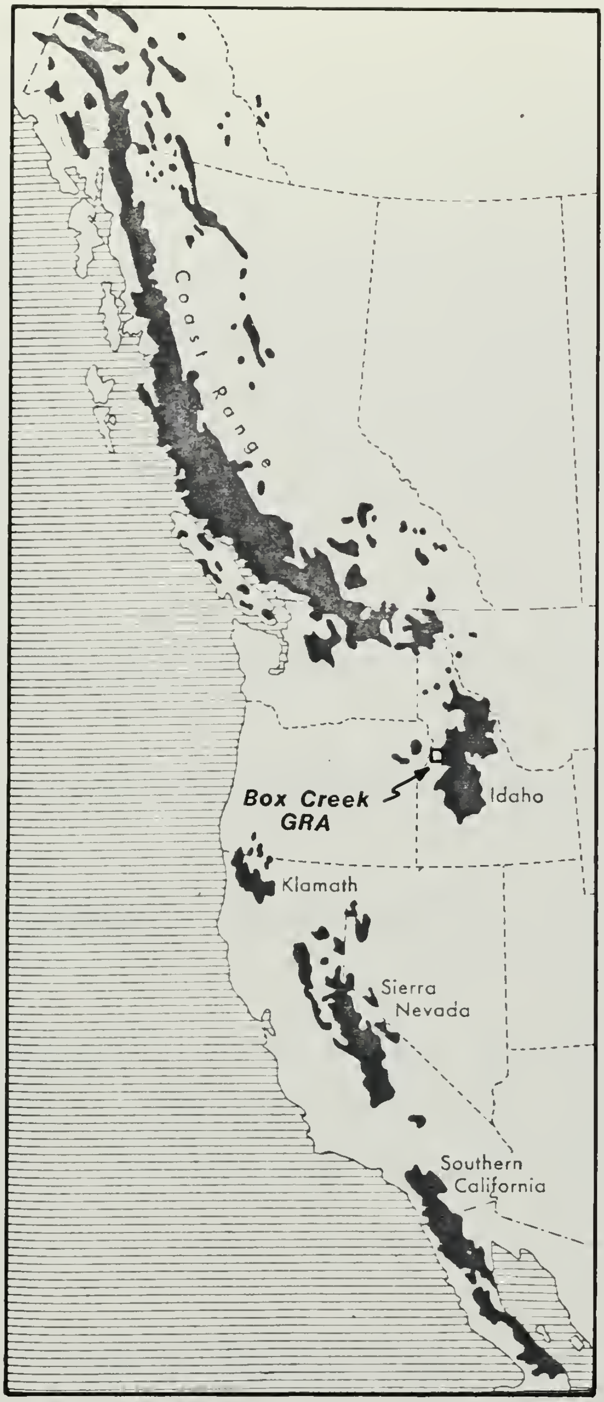
Box Creek GRA, Idaho

Regional Seismicity

SCALE AS SHOWN			FIGURE
DATA BY	DATE 3/1983	REVISED	5
DRWN BY DSI	APRVD G F		

complexes in this belt include the Southern California, Sierra Nevada, Klamath, Idaho, and Coast Range batholiths (Fig. 6).

The Idaho batholith was emplaced into a basement of orthogneiss and metamorphosed Belt Supergroup rocks during Late Cretaceous (100-65 m.y.) time. The batholith was emplaced at considerable depth but unroofed prior to Eocene (55-38 m.y.) emplacement of small granitic plutons and the eruption of the Challis volcanics (Hyndman, 1978).



From: Clark and Stearn (1960).

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BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho

Batholiths of the Nevadan Orogenic Belt in Western North America

SCALE			FIGURE
DATA BY	DATE 3/1983	REV SED	6
DRWN BY DSI	APRVD G F		

3.0 ENERGY AND MINERAL RESOURCES

3.1 Introduction

Data on energy and mineral deposits and occurrences was compiled through a review of all available data. The principal sources are the Bureau of Mines MILS Data File, the USGS CRIB Data File, and the Idaho Bureau of Mines and Geology's Mines and Prospects Map Series (Mitchell et al., 1981a, b; Strowd et al., 1981).

3.2 Known Mineral and Energy Deposits

There are no known mineral or energy deposits in the Box Creek GRA.

3.3 Known Mineral and Energy Prospects and Occurrences

There are no reported mineral or energy prospects or occurrences in the Box Creek GRA. However, four lode claims the Moly #1, 2, 4, and 5, provide indirect evidence that some mineralization, perhaps molybdenite, is present in the GRA.

3.4 Mining Claims, Leases and Material Sites

The locations of patented and unpatented mining claims, mineral, oil and gas leases, and material sites were researched in the public information office

of the BLM office in Boise. The land status information is taken from the BLM Master Title and the oil and gas plats and is current to June 1982.

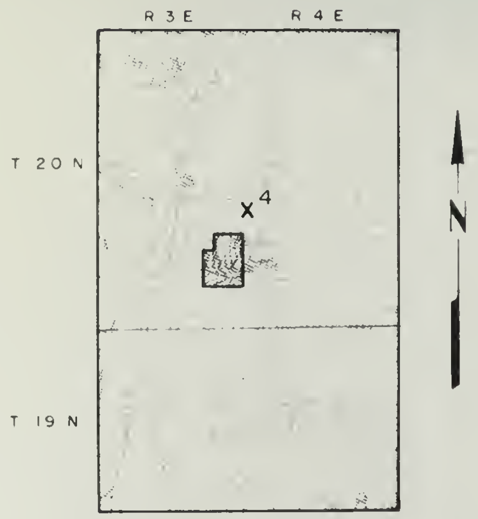
There are four unpatented lode mining claims in the Box Creek GRA (Fig. 7) located approximately 1/2 mile northeast of Box Creek WSA in the west half of sec. 19, T.20N., R.4E. (Moly #1, 2, 4, and 5). There are no mining claims within the Box Creek WSA.

3.5 Mineral and Energy Deposit Types

Based on the geologic environment and mineral deposits which occur elsewhere in the region, several mineral and energy deposit types could occur within the Box Creek GRA. These are sand and gravel, placer euxenite and monazite, vein and pegmatite uranium occurrences, porphyry molybdenum, dimension stone, and geothermal resources.

Sand and gravel accumulations occur in the valley of the North Fork of the Payette River. Within the boundaries of the Box Creek GRA, none of these deposits have been exploited. It is likely that the only economically attractive accumulations are those found in the valley between the inlet of Payette Lake and Box Creek.

Monazite and euxenite were extensively dredged as placer minerals from Quaternary alluvial deposits in Long Valley, between McCall and Cascade, Idaho, during 1951 to 1959 (Schmidt and Mackin, 1970). Savage (1961) reports that serious mining activities began in 1950 when Baumhoff-Marshall Company moved a dredge boat to the Big Creek placer near Cascade and started



EXPLANATION

x *Unpatented Mining Claim*

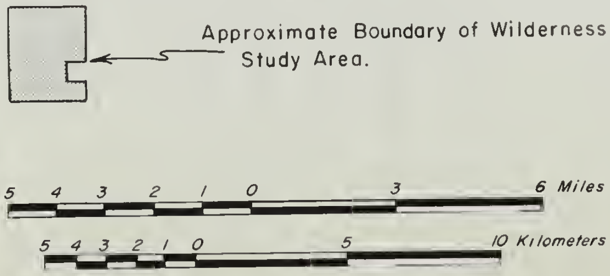
▲ *Patented Mining Claim*

Notes: 1) Number adjacent to symbol indicates number of mining claims in that section.

2) Area of search: Entire GRA.

3) Source of Data: BLM Claims Microfiche

4) Data current to: June 30, 1982



Approximate Boundary of Wilderness Study Area.

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BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho

Mining Claims Density Map

SCALE 1"= 4 MILES			FIGURE
DATA BY WGM	DATE 1/1983	REV SED	7
DRWN BY DSI	APRVD G.F.		

monazite recovery operations. The venture was financed by J.R. Simplot and Baumhoff-Marshall Company who converted a jointly-owned steel mill in Boise into a heavy mineral separation plant. By 1952, Warren Dredging Company and Idaho Canadian Dredging Company were both supplying concentrates to the Boise plant. Both dredges operated 24 hours per day, seven days a week. The placers contained monazite (1.5 lbs./yd.^{3}), zircon (0.2 lbs./yd.^{3}), garnet (5.0 lbs./yd.^{3}), ilmenite (40? lbs./yd.^{3}), and magnetite (1.0 lb./yd.^{3}). These and other accessory minerals were derived from rocks of the Idaho batholith during periods of deep weathering in the Tertiary (65-2 m.y.) and Quaternary. Schmidt and Mackin (1970) conclude that concentration of the heavy minerals in large placers was dependant upon uplift due to block faulting and subsequent periglacial processes of weathering and erosion. Since placer deposits are not being formed at the present time, any placer accumulations of radioactive minerals within the Box Creek GRA would be restricted to the Quaternary gravels perched on the mountain flanks along the North Fork of the Payette River or underlying pre-Holocene (older than 0.1 m.y.) alluvium in the valley bottom.

During a visit to the Box Creek GRA in October 1982 by WGM personnel, three panned concentrate samples were collected from Box Creek and adjacent drainages to the north and south. Thin sections of the non-magnetic fraction from the samples were examined by K. Northcote of Vancouver Petrographics Ltd. These samples contain traces of monazite and allanite. Euxenite was not detected (Appendix II).

Uranium-bearing pegmatites occur in several places in central Idaho including the main part of the Idaho batholith (Cook, 1957; Weis et al., 1958). None of the pegmatites contain economically significant mineralization but they are important as possible sources of uranium minerals in placer deposits.

Uranium-bearing vein deposits occur near Stanley and Hailey along the east flank of the Idaho batholith, near Salmon, and at Lemhi Pass along the Idaho-Montana border (Armstrong, 1964). The vein deposits at Stanley are uraninite-quartz veins and uraninite stringers in fractures in granitic rocks (Kern, 1959). The deposits near Hailey, in the Camas Mining district, consist of veins of uraninite and torbernite in faulted quartz monzonite (Weis et al., 1958). South of Salmon, secondary uranium minerals occur in joints and shears in the Challis Volcanics (Weis et al., 1958). At Lemhi Pass, bastanesite, thorite, monzonite, allanite, xenotime and other thorium minerals occur in quartz-carbonate veins cutting sedimentary rocks of the Belt Supergroup (Staatz, 1972, 1979).

Several porphyry molybdenum-copper deposits occur in association with the Idaho batholith. The majority of these deposits are located along a northeast trending belt termed the "Idaho porphyry belt" (Olson, 1968; Green, 1972). This belt is in a northeast-striking zone of Laramide age dikes and stocks that is continuous from the Boise Basin in Idaho to Butte, Montana. Major deposits present in this belt include the "White Cloud-Cannivan Belt" of stockwork molybdenum deposits. Individual ore deposits are the White Cloud, Thompson Creek, Bobcat Gulch, Cannivan, and Big Ben deposits (Bunning and Burnet, 1981). The ages of the deposits vary: White Cloud at 86 to 87

m.y.; Thompson Creek at 85.9 m.y.; and Bobcat Gulch (the youngest) at 49 m.y. (Armstrong, 1978; Bunning and Burnet, 1981). The presence of porphyry molybdenum-copper deposits in the Box Creek GRA is dependant upon the presence of Laramide-age intrusives. Present mapping is insufficient to confirm or deny the presence of such intrusives.

Some granite in the area could be used for dimension or decorative stone although none seems to have any "special" value.

The geothermal character of this area is discussed by Mitchell et al. (1980) and in more detail by Lewis and Young (1980). There are many hot and warm springs in central Idaho. Most of them are associated with major topographic/linear features and seem to be related to deep circulation along zones of major crustal permeability having a modest background geothermal gradient (25-35°C/km, ±.4-2.0°F/100 ft.). Maximum estimated aquifer temperatures are generally less than 150°C. The North Fork of the Payette River runs along a generally north-south course and there are several hot springs along this trend. None are north of the Cascade Reservoir, about 25 miles south of the Box Creek GRA. Another major north-south linear trend of hot springs occurs along a lineament defined by the Middle Fork of the Payette River and the South Fork of the Salmon River. Lost Creek warm spring, 10 miles east of the Box Creek WSA, is along the latter lineament. The surface temperature of this spring is 33°C (Mitchell et al., 1980) but no water analysis is available for estimation of a possible maximum aquifer temperature.

There is no prospect of hydrocarbon accumulation in the Box Creek GRA or WSA. Igneous rocks are not source beds for hydrocarbons. If any hydrocarbons were present before melting of the parent rock they would be destroyed by the temperatures required to form the igneous rocks. Furthermore, igneous rocks must be buried beneath sedimentary source beds and fractured to be hydrocarbon reservoirs. Since the igneous rocks in the Box Creek are exposed on the surface, they are not favorable reservoir rocks.

3.6 Minerals and Energy Economics

The Box Creek GRA has relatively good access, an ample supply of water, and a nearby labor force. Any mineral deposits located within the GRA should be exploitable without undue hardship.

4.0 LAND CLASSIFICATION FOR GEM RESOURCES POTENTIAL

4.1 Explanation of Classification Scheme

In the following section the land in the the Box Creek WSA is classified for geology, energy and mineral (GEM) resources potential. The classification scheme used is shown in Table I. Use of this scheme is specified in the contract under which WGM prepared this report.

The evaluation of resource potential and integration into the BLM classification scheme has been accomplished using a combination of simple subjective and complex subjective approaches to regional resource assessment (Singer and Mosier, 1981). The simple subjective approach involves the evaluation of resources based on the experience and knowledge of the individuals conducting the evaluations. The complex subjective method involves use of rules, i.e. geologic inference, based on expert opinion concerning the nature and importance geologic relationships associated with mineral and energy deposits (Singer and Mosier, 1981).

The GEM resource evaluation is the culmination of a series of tasks. The nature and order of the tasks was specified by the BLM, however they constitute the general approach by which most resource evaluations of this type are conducted. The sequence of work was: (1) data collection, (2) compilation, (3) evaluation, and (4) report preparation. Some field work was conducted in the Box Creek WSA.

TABLE I

BUREAU OF LAND MANAGEMENT GEM RESOURCES LAND CLASSIFICATION SYSTEM

CLASSIFICATION SCHEME

1. The geologic environment and the inferred geologic processes do not indicate favorability for accumulation of mineral resources.
2. The geologic environment and the inferred geologic processes indicate low favorability for accumulation of mineral resources.
3. The geologic environment, the inferred geologic processes, and the reported mineral occurrences indicate moderate favorability for accumulation of mineral resources.
4. The geologic environment, the inferred geologic processes, the reported mineral occurrences, and the known mines or deposits indicate high favorability for accumulation of mineral resources.

LEVELS OF CONFIDENCE

A. The available data are either insufficient and/or cannot be considered as direct evidence to support or refute the possible existence of mineral resources within the respective area.

B. The available data provide indirect evidence to support or refute the possible existence of mineral resources.

C. The available data provide direct evidence, but are quantitatively minimal to support or refute the possible existence of mineral resources.

D. The available data provide abundant direct and indirect evidence to support or refute the possible existence of mineral resources.

4.2 Classification of the Box Creek Wilderness Study Area (110-91a)

4.2.1 Locatable Minerals

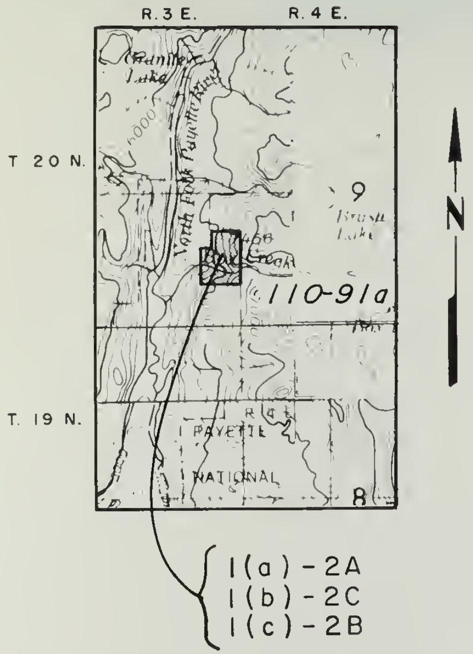
Locatable minerals are those which are locatable under the General Mining Law of 1872, as amended, and the Placer Act of 1870, as amended. Minerals which are locatable under these acts include metals, ores of metals, non-metallic minerals such as asbestos, barite, zeolites, graphite, uncommon varieties of sand, gravel, building stone, limestone, dolomite, pumice, pumicite, clay, magnesite, and silica sand, etc. (Maley, 1980).

4.2.1a Metallic Minerals. The entire area of WSA 110-91a (1a, Fig. 8) is classified as having low potential for porphyry molybdenum-copper and other base-precious metal mineralization, but the available data is insufficient for an adequate evaluation (2A). The basis for the classification are the lack of reported occurrences in the area and apparent lack of Laramide age intrusive rocks in the WSA.

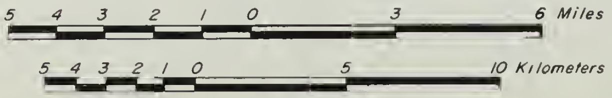
4.2.1b Uranium and Thorium. All of WSA 110-91a (1b, Fig. 8) is classified as having low favorability for uranium and thorium based on limited direct evidence (2C). The classification is based on the generally unfavorable geologic environment, lack of favorable placer gravels, and negative sampling results in the Box Creek area.

4.1.1c Non-Metallic Minerals. WSA 110-91a (1c, Fig. 8) is classified as having low favorability for non-metallic mineral deposits based on indirect evidence (2B). No occurrences are reported in the area.

BLM LAND CLASSIFICATION SYSTEM FOR GEM RESOURCES



Approximate Boundary of Wilderness Study Area.



CLASSIFICATION SCHEME

1. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES DO NOT INDICATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.
2. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES INDICATE LOW FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.
3. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, AND THE REPORTED MINERAL OCCURRENCES INDICATE MODERATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.
4. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, THE REPORTED MINERAL OCCURRENCES, AND THE KNOWN MINES OR DEPOSITS INDICATE HIGH FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

LEVELS OF CONFIDENCE

A. THE AVAILABLE DATA ARE EITHER INSUFFICIENT AND/OR CANNOT BE CONSIDERED AS DIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES WITHIN THE RESPECTIVE AREA.

B. THE AVAILABLE DATA PROVIDE INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

C. THE AVAILABLE DATA PROVIDE DIRECT EVIDENCE, BUT ARE QUANTITATIVLEY MINIMAL TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

D. THE AVAILABLE DATA PROVIDE ABUNDANT DIRECT AND INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

EXPLANATION

Area I.D. Number
I(a)- 4D
Commodity
Classification
Level of Confidence

a) Metallic Minerals
b) Uranium and Thorium
c) Non-Metallic Minerals

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Anchorage, Alaska

BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho
Wilderness Study Area
Land Classification
Locatable Resources

SCALE. 1" = 4 MILES (1:250,000)			FIGURE
DATA BY WGM	DATE 9/1982	REVISED	8
DRWN BY DSI	APRVD G.F		

4.2.2 Leasable Resources

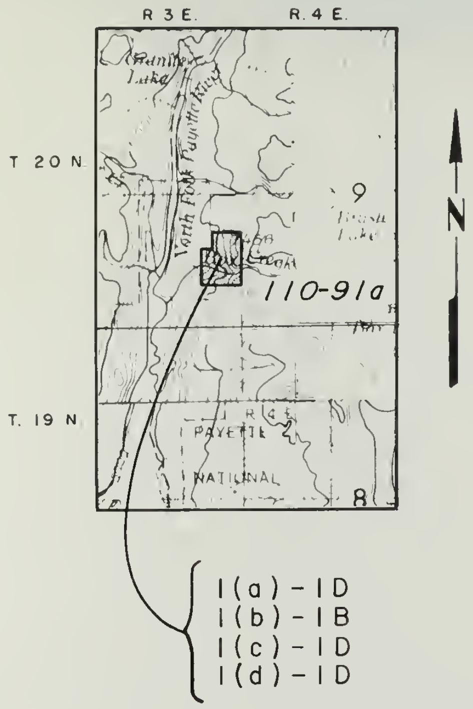
Leasable resources include those which may be acquired under the Mineral Leasing Act of 1920 as amended by the Acts of 1927, 1953, 1970, and 1976. Materials covered under this Act include: asphalt, bitumen, borates of sodium and potassium, carbonates of sodium and potassium, coal, natural gas, nitrates of sodium and potassium, oil, oil shale, phosphate, silicates of sodium and potassium, sulfates of sodium and potassium, geothermal resources, etc. (Maley, 1980).

4.2.2a Oil and Gas. WSA 110-91a (1a, Fig. 9) is classified as unfavorable for the occurrence of hydrocarbon resources based on direct evidence (1D). The igneous rocks underlying the WSA cannot be source beds for hydrocarbons nor are they favorable reservoir rocks.

4.2.2b Geothermal. WSA 110-91a (1b, Fig. 9) is classified as unfavorable for both low and high temperature geothermal resources based on indirect evidence (1B). The WSA is not on a major cross structure which might provide a zone of crustal permeability. It is also unlikely that any blind geothermal system exists.

4.2.2c Sodium and Potassium. All of WSA 110-91a (1c, Fig. 9) is classified as unfavorable for sodium and potassium based direct evidence (1D). The area is entirely underlain by intrusive rocks.

BLM LAND CLASSIFICATION SYSTEM FOR GEM RESOURCES



CLASSIFICATION SCHEME

1. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES DO NOT INDICATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

2. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES INDICATE LOW FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

3. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, AND THE REPORTED MINERAL OCCURRENCES INDICATE MODERATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

4. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, THE REPORTED MINERAL OCCURRENCES, AND THE KNOWN MINES OR DEPOSITS INDICATE HIGH FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

LEVELS OF CONFIDENCE

A. THE AVAILABLE DATA ARE EITHER INSUFFICIENT AND/OR CANNOT BE CONSIDERED AS DIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES WITHIN THE RESPECTIVE AREA.

B. THE AVAILABLE DATA PROVIDE INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

C. THE AVAILABLE DATA PROVIDE DIRECT EVIDENCE, BUT ARE QUANTITATIVLEY MINIMAL TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

D. THE AVAILABLE DATA PROVIDE ABUNDANT DIRECT AND INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

EXPLANATION

1(a) - 4D

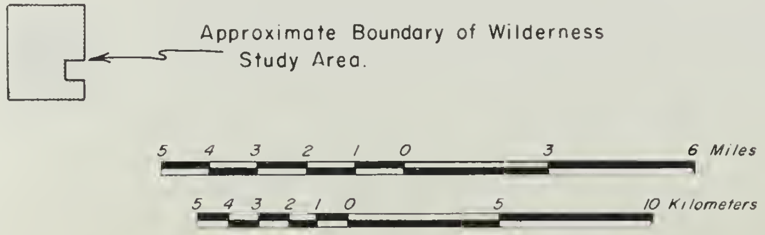
Area I.D. Number
Commodity
Classification
Level of Confidence

a) oil and gas

b) Geothermal: high temperature (H), Low temperature (L)

c) Sodium and Potassium

d) others: Asphalt (As) bitumen (bt), phosphate (ph), No specific commodity designation indicates that the rating applies to all of the above.


Approximate Boundary of Wilderness Study Area.
5 4 3 2 1 0 3 6 Miles
5 4 3 2 1 0 5 10 Kilometers

WGM Inc. Mining and Geological Consultants
Anchorage, Alaska

BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho
Wilderness Study Area
Land Classification
Leasable Resources

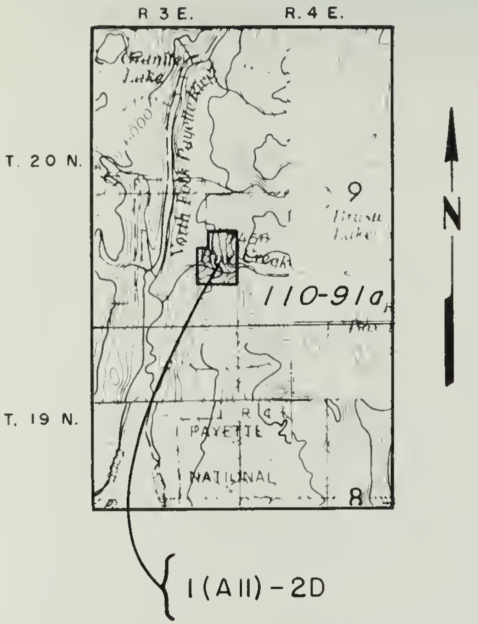
SCALE 1"= 4 MILES (1:250,000)
DATA BY WGM DATE 9/1982 REVISED
DRWN BY DSI APRVD G.F
FIGURE 9

4.2.2d Other. All of WSA 110-91a (1d, Fig. 9) is classified as unfavorable for the occurrence of asphalt, bitumen, coal, oil shale and phosphate based on direct evidence (1D). The area is entirely underlain by intrusive rocks.

4.2.3 Saleable Resources

Saleable resources include those which may be acquired under the Materials Act of 1947 as amended by the Acts of 1955 and 1962. Included under this Act are common varieties of sand, gravel, stone, cinders, pumice, pumicite, clay, limestone, dolomite, peat and petrified wood (Maley, 1980).

The entire area of WSA 110-91a (1, Fig. 10) is classified as having low favorability for saleable resources based on direct evidence (2D).



BLM LAND CLASSIFICATION SYSTEM FOR GEM RESOURCES

CLASSIFICATION SCHEME

1. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES DO NOT INDICATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.
2. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES INDICATE LOW FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.
3. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, AND THE REPORTED MINERAL OCCURRENCES INDICATE MODERATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.
4. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, THE REPORTED MINERAL OCCURRENCES, AND THE KNOWN MINES OR DEPOSITS INDICATE HIGH FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

LEVELS OF CONFIDENCE

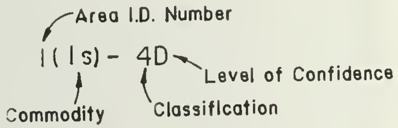
A. THE AVAILABLE DATA ARE EITHER INSUFFICIENT AND/OR CANNOT BE CONSIDERED AS DIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES WITHIN THE RESPECTIVE AREA.

B. THE AVAILABLE DATA PROVIDE INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

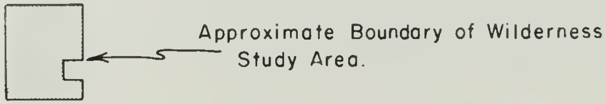
C. THE AVAILABLE DATA PROVIDE DIRECT EVIDENCE, BUT ARE QUANTITATIVLEY MINIMAL TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

D. THE AVAILABLE DATA PROVIDE ABUNDANT DIRECT AND INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

EXPLANATION



s	Sand
g	Gravel
st	Stone
c	Cinders
p	Pumice
pt	Pumicite
cl	Clay
Ls	Limestone
dl	Dolomite
P	Peat
pw	Petrified wood



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Anchorage, Alaska

BLM GEM RESOURCES ASSESSMENT
REGION 2 NORTHERN ROCKY MOUNTAINS

Box Creek GRA, Idaho
Wilderness Study Area
Land Classification
Saleable Resources

SCALE 1"=4 MILES (1:250,000)			FIGURE
DATA BY WGM	DATE 9/1982	REVISED	10
DRWN BY DSI	APRVD G.F		

5.0 RECOMMENDATIONS FOR FURTHER WORK

Stream silt samples should be collected from Box Creek and the drainages to the north. These should be analyzed for copper, lead, zinc, molybdenum, and silver. Also, the four lode claims in the western half of sec. 19, T.20N., R.4E. should be examined to determine if molybdenum mineralization is present. Data from the investigations suggested above might raise the ranking for metallic minerals, and it certainly would increase the confidence level of the ranking.

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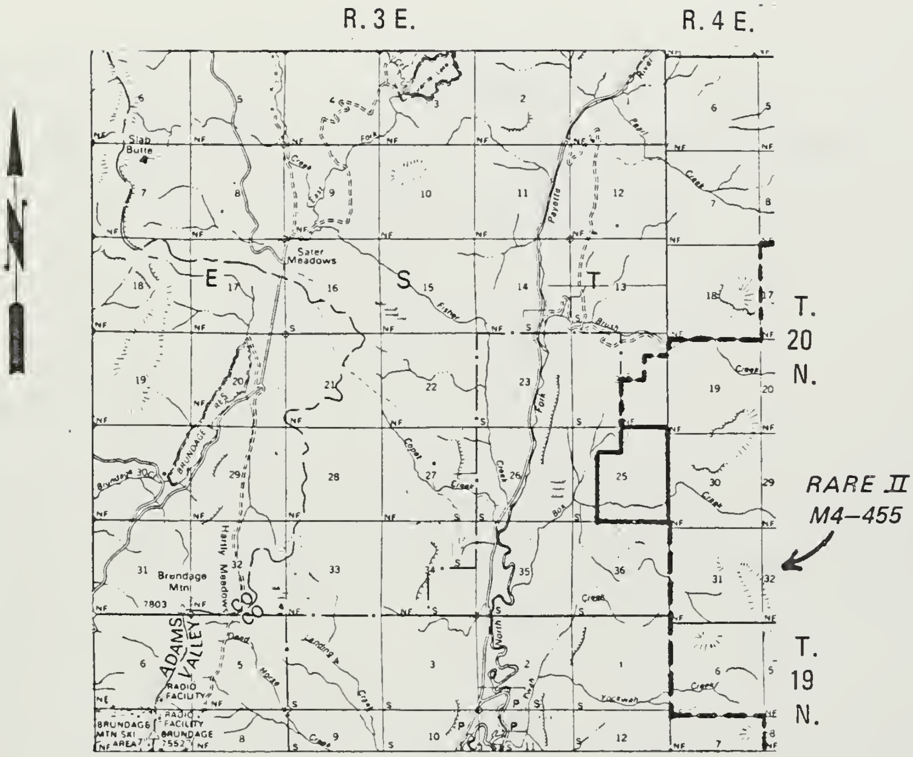
APPENDIX I

WILDERNESS STUDY AREA MAP

110 91a

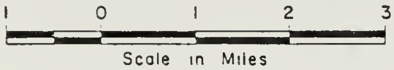
BOX CREEK



LEGEND

⬭ WILDERNESS STUDY AREA

▨ AREA WITHOUT CHARACTERISTICS



APPENDIX II

ANALYTICAL REPORT ON PANNED CONCENTRATE SAMPLES FROM THE BOX CREEK GRA

VP
Vancouver Petrographics Ltd.

JAMES VINNELL, Manager
JOHN G. PAYNE, Ph. D. Geologist

P.O. BOX 39
8887 NASH STREET
FORT LANGLEY, B.C.
VOX 1JO

PHONE (604) 888-1323

January 26, 1983 83-1(7)

Bondar-Clegg
Geology Department
130 Pemberton Avenue
North Vancouver B.C.
V7P 2R5

Dear Sirs: Re: Petrographic Analyses
Samples 122-430-28037,38 & 39
Invoice No. 3710

Thin sections of grains from the non magnetic fraction of samples 122-430-28038 & 28039 were examined and minerals present listed with approximate percentages. In particular the samples were checked for presence of euxenite and monazite. Probable monazite was detected in trace amounts; euxenite was not detected.

Sphene-Monazite

The samples are sphene (titanite)-rich (5% or less) which has similar optical properties to monazite. Sphene was determined because of its extreme relief and birefringence,color, multiple twinning of some grains, and extinction angle. The characteristic shape of crystals of sphene are lacking but the mineral was noted as composite grain intergrowths with other minerals; an unlikely habit for monazite. Suspected monazite grains, 1 to 3 in each section, are euhedral, have a very small extinction angle of a few degrees and a lower birefringence than the maximum for sphene. Monazite and zircon can also be confused but zircon has parallel extinction.

Allanite-Euxenite

Allanite was determined on the basis of its brown color, pleochroism, high birefringence, lack of good cleavages (hornblende), poor interference figure biaxial (-) 2v about 70° (?) and association with epidote to which it is related.

Euxenite was not detected in the thin sections but if present would also have a brown color. It is a biaxial mineral but, because it is metamict, should appear isotropic. The isotropic minerals that do appear in the section are probably garnet which is colorless to pale pinkish in plain light.

Recommendations

In order to further investigate euxenite-monazite content of these fractions, further concentration by heavy liquid separation is recommended.
Monazite Sp.Gr. about 5.1
Euxenite Sp.Gr. 4.8 to 5.9
Most of the mineral grains in the samples, with exception of the heavy fraction of interest, have specific gravities less than 3.5.

Heavy mineral separation followed by X-ray powder photographs, X-ray diffraction, microprobe or measurement of radioactivity would assist in isolation and positive identification of these minerals.

K E Northcote

K.E.Northcote Ph.D.,P.Eng.

BONDAR-CLEGG

122-430-28037 Grain thin section

Microscopic

Minerals present, percentages are visual estimates.

Plagioclase; 20% An_{37}

Orthoclase/Microcline; 5%, confirmed in stained grain mount.

Quartz; 30%

Hornblende; 30% (a) green 25%
(b) brown < 5%

Biotite; < 1%

Augite; < 5%

Allanite < 1% brown color, pleochroic, high birefringence with epidote associated.

Epidote < 1% free grains and alteration of hornblende

Garnet; < 1% isotropic

Sphene; 5%

Monazite; trace, subhedral/euhedral (0.08mm) (0.1mm) low angular extinction

Opaque; < 1%

Euxenite; not detected.

122-430-28038 Grain thin section

Microscopic

Minerals present, percentages are visual estimates

Plagioclase; 30% An_{38}

Orthoclase/Microcline; 5%, confirmed in stained grain mount.

Quartz; 35%

122-430-28038 (Continued)

Hornblende 15% (a) green 10%
(b) brown < 5%

Biotite; < 1% chloritic

Augite; < 5%

Allanite; < 1%, brown, pleochroic, birefringence as for epidote, associated with epidote.

Epidote; < 1%

Sphene; 5%, multiple twinning, brownish, slight pleochroism, high birefringence

Garnet; < 1% (a) slight pinkish tint
(b) slight greyish tint

Monazite; trace, similar optical properties to sphene, lower birefringence, low angular extinction, euhedral grains (.06mm and 0.28mm)

Euxenite; not detected

Opaque; < 1%

122-430-28039 Grain thin section

Microscopic

Minerals present, percentages are visual estimates

Plagioclase; 30%, An_{38}

Orthoclase/Microcline; 5%, confirmed in stained grain section and microcline twinning

Quartz; 35%

Hornblende; 10% (a) green < 10%
(b) brown < 1%

Biotite; < 10%

Augite; < 5%

Epidote; < 1%

Allanite; < 1%, brown, pleochroic, high birefringence biaxial (-) 2v 70° (?)

122-430-28039 (Continued)

Sphene; 5%

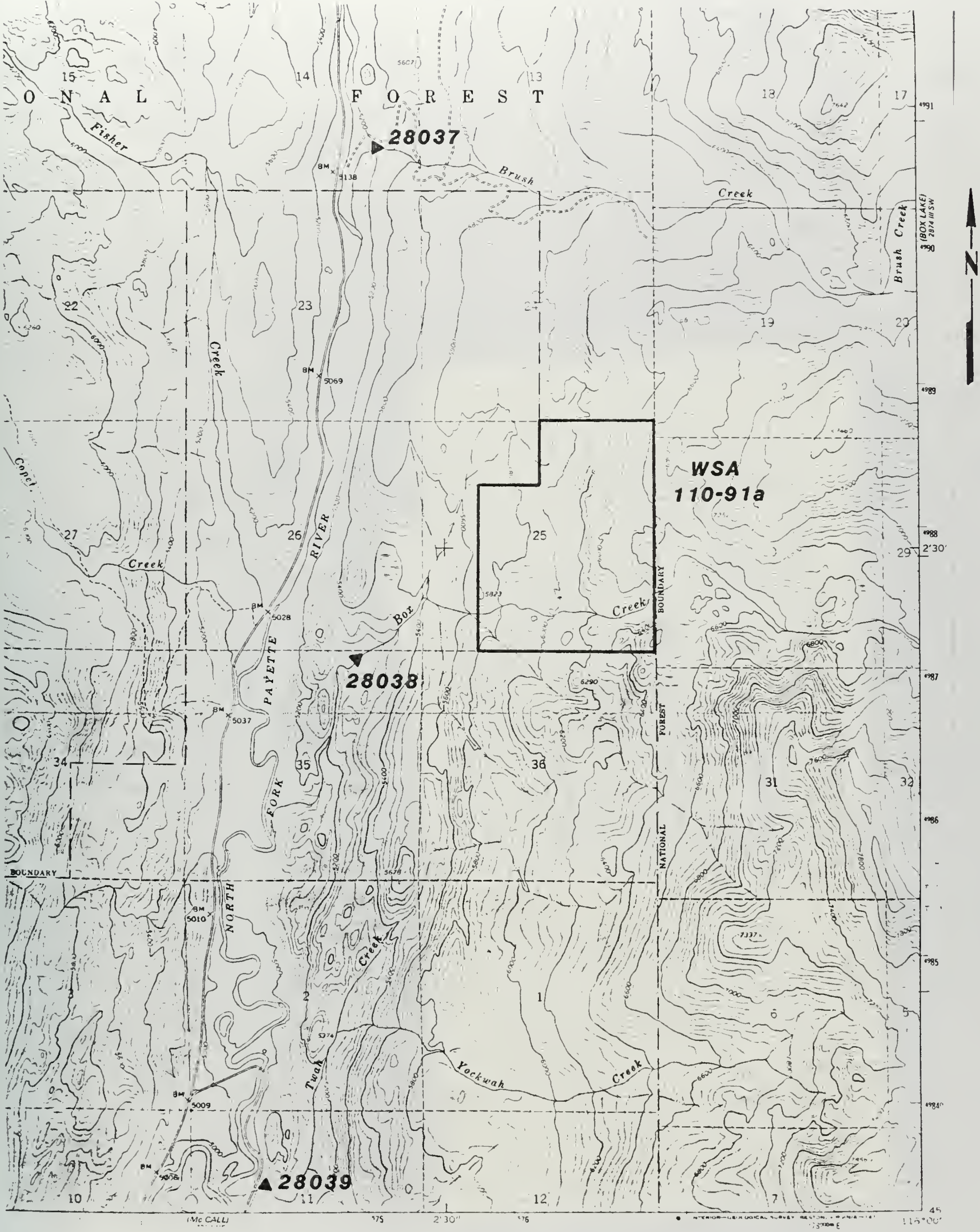
Garnet < 1% isotropic

Monazite; trace, euhedral, (0.1mm) slight inclined extinction

Euxenite; not detected

Opaque < 1%

Lithic fragment; volcanic
plagioclase laths, augite, opaque, brown alteration



1 Mile

Box Creek GRA, Idaho
Location of Panned
Concentrate Samples

Form 1279—3
(June 1984)

BORROWER'S

QE 104 .B69 F73
Fredericksen, R.
Geology; energy
(GEM) resource

DATE LOANED	BORROWER

USDI — BLM